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RESEARCH ORIENTED TECHNOLOGICAL NEEDS IN THE SYDNEY COALFIELD

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by

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The future of the Sydney Coalfield will only be assured if there is recognition that access to major reserves can only be gained at increasing depths associated with increasingly greater distance from the coast. This factor coupled with the site specific problems that are recognized in this coalfield suggest that a variety of technological needs must be addressed and resolved if safe productive coal mining at reasonable cost is to continue into the next century.

This document attempts to identify the major technological needs of the Sydney Coalfield with emphasis on the site-specific issues which must be resolved by local action. The emphasis is also upon research as opposed to operational needs.

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RECHERCHE PORTANT SUR LA SOLUTION DES PROBLÈMES TECHNIQUES DE LA HOUILLÈRE DE SYDNEY

par

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RÉSUMÉ

L'avenir de la houillère de Sydney ne sera définitivement assuré que lorsque l'on se rendra compte que l'accès aux réserves de charbon principales n'est possible qu'à des profondeurs de plus en plus importantes et à une distance toujours plus considérable de la côte. Cet élément qui s'ajoute aux problèmes particuliers de l'emplacement de cette houillère mérite d'être étudié et solutionné si des travaux d'extraction minière doivent s'y poursuivre à des coûts d'exploitation raisonnables au cours du siècle à venir.

Dans ce rapport on tente d'identifier les besoins principaux de la houillère de Sydney en matière de technologie et on accorde une importance particulière aux problèmes spécifiques qui découlent de l'emplacement et qui doivent être résolus par des activités au niveau local. On souligne également qu'il est nécessaire de s'intéresser davantage à la recherche technologique qu'aux besoins qui se manifestent au niveau opérationnel.

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INTRODUCTION

The Sydney Coalfield is the largest coalfield in Eastern Canada. In the medium and long term, coal will be mined to meet the needs of the Atlantic Region's thermal fired electric utilities as well as emerging technologies like Carbogel and coal liquifaction.

The geographical extent and geological nature of the Sydney Coalfield has been well described by others. This coalfield is primarily submarine and future production will come from mining at greater depth with longer distances from the coastline. The specific constraints facing mining engineers and mine planners in the Sydney Coalfield are well recognized and do not need elaboration here. Those constraints in turn suggest a suite of research oriented technological needs which are the substance of this report. It is hoped that the listing of these research oriented technological needs will serve two purposes:

1. To direct the long term goals of the Cape Breton Coal Research Laboratory.
2. To focus the thinking of all parties concerned in an effort to identify long term research needs in the Sydney Coalfield.

TECHNOLOGICAL NEEDS

Any attempt to look forward is fraught with uncertaincy. Technology changes in the long term are difficult to predict. For example conventional underground coal mining could be rendered unattractive by alternative energy developments or by alternative extraction systems like insitu gasification.

For the purposes of this report it is assumed that miners will continue to work underground to win coal from the submarine coal seams in the Sydney Coalfield. No attempt will be made to predict the penetration of robots and other emerging workforce replacement devices. It is assumed that people will continue to be required to direct and maintain any such equipment. In other words the skills and abilities of coal miners may change but coal miners will still be required.

THE MINE ENVIRONMENT

There are two basic choices for underground coal mines:

a) control methane, respirable dust and heat to acceptable levels to provide good environmental conditions for a barefaced workforce, or

b) provide the workforce with self-contained breathing and temperature control suits (i.e. spaceman concepts).

While various combinations of the above two choices are also possible it is considered likely that acceptable environmental conditions for a barefaced workforce will continue to be the preferred option.

With increasing depth and greater horizontal distance mine ventilation system design will become more exacting and difficult. Although the Sydney Coalfield is blessed with a low geothermal gradient by world mining standards, heat stress could become a problem at depths greater than 900 m. The heat problem will be minor when compared with the difficulties encountered by other hard rock and coal mining camps in various parts of the world. Acceptable levels of cooling will be obtained via direct technology transfer from those "heat problem" mining camps.

In recent years controlled recirculation ventilation has been the subject of active research. The advantages and disadvantages are well known. In terms of the Sydney Coalfield controlled recirculation ventilation is a particularly attractive option that must be considered. The economics of larger roadway cross section to reduce pressure loss in lengthy ventilation circuits also suggests that booster fans will continue to be required even if controlled recirculation ventilation is adopted.

Bored ventilation shafts and raises would be the obvious choice if the Sydney Coalfield was not submarine. The advantages of such airways coupled with the relatively shallow depth of water in the offshore suggests that artificial islands may prove attractive. The cost and difficulty of construction and maintenance of such islands in the hostile Atlantic is not underestimated but in comparison the problems associated with extended conventional ventilation may prove equally onerous.

A review of respirable dust compliance sampling results for the past decade suggests that no significant improvement in worker exposure has been realized in spite of dust control initiatives. The history of occupation health suggests that future limits of worker exposure will be lower than current standards. Respirable dust control is not a problem that is unique

to the Sydney Coalfield. Control and reduction of worker exposure to respirable dust will be a future requirement for which there is no simple solution. In the U.S. significant gains have been made in personal sampling results through tailoring faceline operations to maintain all workers on the intake side of the face cutting machine (i.e unidirection cutting). Such modifications are possible in retreat mining sections equipped with multiple entries on each face end.

Experience in past and present collieries in the Sydney Coalfield suggests that methane emission becomes both greater and more variable with increasing depth. Improved methane drainage and consideration of predrainage is imperative if methane problems are to be prevented from becoming a major impediment to productivity. Greater attention must be paid to methane prediction and control particularly in high output work places.

GEOTECHNICAL ASPECTS

The remaining near surface (near shore) reserves are particularly attractive. When combined with multiple seam extraction the implications of overly conservative seabed tensile strain criteria becomes apparent. A field validated model of subsidence for the Sydney Coalfield is a requirement if any relaxation of the existing tensile strain criteria is to be realized.

As depth increases, roadway and faceline support requirements increase. Since increasing depths in the Sydney Coalfield is expected to be gradual, continuing field geotechnical investigations and operator initiated modifications should result in adequate control of roadway and faceline conditions.

The recent outbursts of rock and gas at No. 26 colliery are of greater concern. The outburst prone strata is not unique to No. 26 and geological evidence combined with core discing in drillholes suggests that similar events may occur elsewhere in the coalfield at similar and greater depths. Control of outbursts is felt to be the most pressing technological need in the Sydney Coalfield.

Non-flammable alternatives to wood for support is also a pressing need. The existing CBDC plan to initiate monolithic packing on 9 East at Lingan Colliery is seen as an important step that will provide valuable experience with wood replacement technology. Success with that trial is

expected to lead to rapid adoption of wood replacement technology elsewhere in CBDC mines. Wood replacement technology is an industry-wide concern.

EQUIPMENT

Canada is a small underground coal producer by world standards. It is both unrealistic and impractical to suggest that Canada provide world leadership in coal mine equipment design. A more cost effective approach is to maintain an awareness of equipment developments elsewhere and examine such developments with a view to their possible application and utility in Canadian conditions.

Opportunities do exist however for cooperative demonstrations with manufacturers particularly when the product is not totally coal mine specific. A good example of such a project is the Lovat 7.6 m diameter TBM.

A similar opportunity exists to develop and demonstrate rapid efficient personnel and materials transportation technology for long decline drivages that exist in CBDC mines.

Several good examples of demonstrations of suitable equipment developed outside Canada also exist. The water jet assisted roadheaders at Lingan Phalen, the polycrystalline diamond insert pick trials and the forthcoming thru-flush pick trials are all good examples of foreign developments that have merit and are being evaluated to assess their suitability in the Sydney Coalfield. All three examples are attempts to reduce or control frictional ignition problems associated with drag-style bit cutting. Such trials should be encouraged and continued as equipment developments occur.

CONCLUSIONS

The Sydney Coalfield like other coal mining areas is faced with a number of technological problems and issues that must be addressed if coal is to continue to be produced economically and safely. Many of these problems/issues are industry-wide. Solutions can be found to such problems through site-specific research coupled with a willingness to adapt technology developed elsewhere.

Other problems are much more site-specific and are unlikely to greatly benefit from developments elsewhere. It is this subset of technological problems that must be addressed through locally initiated and managed research. Technological issues which fall into this category include:

a) Rock/Gas Outbursts

b) Personnel/Materials Transportation in Declines

c) Controlled Recirculation Ventilation

d) Submarine Subsidence

e) Off-shore Islands

Failure to address these issues locally prejudices the long term viability of underground submarine coal mining in the Sydney Coalfield. In structuring R & D plans the Cape Breton Coal Research Laboratory must recognize these coalfield specific technological requirements. Support for such work must also be received from industry, labour, government and regulatory officials.